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## REFERÊNCIA

ALVES, Luciana Mendonça et al. Phonological processing in individuals with attention deficit hyperactivity disorder, **CEFAC Saúde e Educação**, São Paulo, v. 16, n.3, p. 874-882, May/Jun. 2014. Disponível em: < [http://www.scielo.br/pdf/rcefac/v16n3/en\\_1982-0216-rcefac-16-3-0874.pdf](http://www.scielo.br/pdf/rcefac/v16n3/en_1982-0216-rcefac-16-3-0874.pdf)>. Acesso em: 03 fev. 2015. <http://dx.doi.org/10.1590/1982-021620145813>.

# PHONOLOGICAL PROCESSING IN INDIVIDUALS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

## *Processamento fonológico em indivíduos com transtorno de déficit de atenção e hiperatividade*

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### ABSTRACT

**Purpose:** to analyze and to describe the skills' performance of the phonological processing components in subjects with Attention Deficit - Hyperactivity Disorder (ADHD). **Methods:** it is a descriptive analytical study of the evaluation data of the phonological processing skills of 45 subjects, with ages between 7 and 16 years, with a multiprofessional diagnosis of ADHD. All data was obtained from the medical records of the subjects evaluated by the Laboratório de Estudo dos Transtornos de Aprendizagem (LETRA) of Hospital das Clínicas da Universidade Federal de Minas Gerais (UFMG), between the years of 2008 and 2011. The analyzed results include the Phonological Awareness test, proposed by the battery of tests BELEC, the Rapid Serial Naming (RAN) test and Auditory Memory test. Two variables were considered in this analysis: the age and the presence or absence of associated comorbidities. The test used to the sample characterization was the nonparametric of Mann Whitney. **Results:** groups tend to differentiate themselves when the age variable is analyzed, on the Phonological Awareness tests and RAN. When the comorbidity variable was analyzed, the Phonological Awareness was more influenced by the presence of comorbidities. On the Auditory Memory skills, by the same light, there were no differences between the groups. **Conclusion:** the largest deficit in phonological processing was observed in phonological awareness skills, according to the age and comorbidity variables, followed by the lexicon's access skills, according to the age variable. About the Working Memory, there was no significance.

**KEYWORDS:** Attention Deficit Disorder with Hyperactivity; Learning; Child; Memory; Cognition

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### INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a neurobiological condition more commonly found in males, which is manifested in childhood and adolescence and can persist into adulthood in around 60% to 70% of cases. Evidence indicates that genetic and neurological factors are possible causes, which reduces—albeit not excluding—the contributive role of socio-environmental factors in the development of comorbid conditions. The prevalence of ADHD is estimated at 3% to 5% of school-age children<sup>1,2</sup>. Symptoms include difficulties in attentional behavior, persistent hyperactivity and impulsiveness<sup>1,2</sup>. As a rule, these children are

labeled by the school community as undisciplined, absent-minded, impatient and extremely restless<sup>3,4</sup>.

Establishing the diagnosis requires the persistence of symptoms for at least six months interfering with at least two social settings; impairments in academic standards must be present, and the symptoms are not better explained by another mental disorder<sup>1</sup>. The presentation is investigated by a thorough evaluation of the clinical behavioral status with history-taking and information from different sources and in a variety of situations, in addition to an assessment of the child's behavior in the school environment<sup>5</sup>. The diagnosis is typically made by a neurologist or psychiatrist, and follow-up should preferably be undertaken by an experienced multiprofessional team including the neurologist (or psychiatrist), pediatrician (if applicable), psychologist<sup>1</sup>, speech and language pathologist<sup>5</sup>, among others. One study has reported that other professionals who participate in the multidisciplinary team, such as general practitioners, pediatricians, pedagogues and educators, do not regard themselves as capable of making the diagnosis. In addition, they stress the crucial importance of instituting programs to provide support to these professionals so the best assistance can be offered to individuals with ADHD, thus minimizing the deficits associated with this condition as a result of the behavioral difficulties that involve neurobiological alterations<sup>5</sup>.

Previous studies correlating ADHD with the development of written language concluded that the most prevalent learning disabilities compromise the areas of reading (8%–39%) and writing (60%)<sup>3,5,6</sup>. Moreover, those studies enabled hypotheses proposing that the language deficits in children with ADHD may be directly linked to cognitive activities coordinated by organized behaviors including aspects of speech<sup>3</sup>. These activities are classified as executive functions and comprise goal-setting, planning, initiation, control, inhibition of interference, fluency, speed, temporal organization, sequencing, comparison, classification and categorization, all associated with the cortical and subcortical systems of the frontal lobes<sup>2,3</sup>.

Reflecting the behavioral features manifested by children with ADHD, it is in the school environment that the restlessness and impulsivity are seen as indiscipline and disrespect for the community norms, and the inattention as carelessness, since these symptoms can be observed previously to pre-school<sup>6</sup>. However, the parents and professionals who assist these children may have difficulty establishing the diagnosis of ADHD before the child experiences environments other than the family household. Moreover, it is quite challenging

to diagnose ADHD at the age of four or five<sup>1</sup>. The language deficit in ADHD may impair the learning of the alphabetic writing system, considering that skills underlying this process compromise such acquisitions<sup>7</sup>.

Learning disabilities observed in ADHD involve possible alterations in phonological processing, since the development of reading and writing requires that ability to a great extent. This form of processing consists of mental skills of information processing based on the phonological structure of oral language. It has components connected with reading and writing acquisition: phonological awareness, phonological working memory and mental lexicon access speed (rapid naming)<sup>8</sup>. These components enable the processing and organization of language. They are recruited by the central executive function for the performance of any task, including phonological awareness and phoneme-grapheme correspondence tasks<sup>9,10</sup>.

Therefore, in order for reading competency to be acquired, it is indispensable to have cognitive, perceptive-linguistic skills, which comprise the ability to focus attention, maintain concentration and follow instructions, as well as the ability to grasp and interpret the language, develop and broaden the vocabulary and produce reading fluency. Learning competency, on the other hand, requires the systematic processing of information regarding a variety of skills, chiefly attentional cognitive, mnemonic and linguistic skills, in addition to emotional and behavioral maturity<sup>11,12</sup>.

The literature suggests that individuals with ADHD exhibit alterations in one or more components of phonological processing, which could be related to failure in school. Furthermore, failure also seems to be associated with the triad of symptoms found in these individuals: restlessness, impulsivity and inattention<sup>3,13,14</sup>. Another factor thought to compound this picture is the presence of comorbid disorders. The present study is thus justified in that the development of learning requires the integration of cognitive and information processing aspects and skills such as phonological awareness, access to the mental lexicon and phonological working memory.

The general purpose of the present study was to analyze and describe the phonological processing of individuals diagnosed with ADHD at school age.

## ■ METHODS

This study was initiated after approval by the Research Ethics Committee of the Universidade Federal de Minas Gerais, under protocol no. 0589.0.203.000-11. All those legally in charge of

the study participants provided written informed consent.

The study reported herein was analytical-descriptive and designed to evaluate the phonological processing skills of individuals with a multiprofessional diagnosis of ADHD. The data were obtained from the database of the Laboratório de Estudo dos Transtornos da Aprendizagem (LETRA, Laboratory for the Study of Learning Disorders) at the Hospital das Clínicas of the Universidade Federal de Minas Gerais (UFMG) among patients evaluated between the years 2008–2011.

The data were collected by a member of the LETRA team and tabulated on an Excel spreadsheet version 2010 without identification of the participants.

The study sample comprised 45 individuals aged between 7 and 16 years 11 months, with a multiprofessional diagnosis of ADHD established by the LETRA team. Twenty-one individuals were diagnosed with pure ADHD and 24 had ADHD with comorbid conditions.

Two variables were considered: age range and comorbidity. The variable “age range” was divided into two groups: group 1 (G1) for participants aged 7 years to 10 years 11 months, with 26 individuals (57.78%), and group 2 (G2) for participants aged 11 years to 16 years 11 months, with 19 individuals (42.22%). The variable “comorbidity” was also divided into two groups: presence of a comorbid disorder, with 24 individuals (53.3%), and absence of such a disorder, with 21 individuals (46.7%).

In the evaluation performed by LETRA, the following instruments were used: the BELEC battery of tests adapted to Portuguese<sup>15,16</sup>, adapted Rapid Automatized Naming (RAN) test<sup>17</sup> and Verbal Operating memory test<sup>18</sup>. Based on these data, the phonological processing alterations found in those individuals were analyzed.

Measures of descriptive statistics (mean, standard deviation, coefficient of variation, confidence interval, maximum, minimum and number) were obtained to characterize the sample and enable an analysis of each test. Since the results had no normal distribution and showed independent variables, the nonparametric Mann-Whitney test was used, with the level of significance set at 5%.

## ■ RESULTS

In order to characterize the sample, three groups were considered: a group without comorbid conditions, a group with comorbid conditions, and the total sample. The mean age for the noncomorbid ADHD group was higher than that for the comorbid ADHD group (11 years 5 months vs. 10 years, respectively). The overall mean age was 10 years 7 months. The standard deviation was 2.0 for the individuals without comorbid disorders and 2.3 for the individuals with comorbid ADHD and for the total sample. The coefficient of variation was 17.2 for the group without comorbid conditions, 23.1 for the group with comorbid conditions, and 21.3 overall. Minimum and maximum ages and number of individuals in each group were, respectively: 7 years 8 months, 14 years 5 months, and n=21; 7 years, 16 years, and n=24; 7 years, 16 years, and n=45. The overall sample consisted of 36 male (80%) and 9 female individuals (20%).

The nonparametric Mann-Whitney test was applied in the comparison of the two groups separated by age range. The results pointed to a tendency of differentiation between groups with respect to age range (Table 1). For that reason, the descriptive charts were constructed separating G1 from G2.

**Table 1 - Comparison of groups G1 and G2 according to the variable “age” for the results of the phonological awareness, auditory memory and RAN tests**

Phonological Awareness	Group	Mean	SD	CV	Median	Minimum	Maximum	p-value
Rhyme	G1	6.5	2.23	34.33	8	0	8	0.2
	G2	7.21	1.03	14.31	8	5	8	
Syllable deletion	G1	8.96	2.01	22.42	10	2	10	0.06
	G2	9.79	0.63	6.44	10	8	10	
Syllable reversion	G1	7.62	3.54	46.55	10	0	10	0.04*
	G2	9.21	1.18	12.84	10	6	10	
Phoneme segmentation	G1	4.46	2.9	65.03	4	0	8	0.007*
	G2	6.42	1.71	26.63	7	2	8	
Phoneme deletion (CVC and CCV)	G1	11.12	7.45	67.05	12	0	20	0.001*
	G2	17.16	3.92	22.84	18	8	20	
Phoneme reversion	G1	6.12	3.59	58.75	7	0	10	0.1
	G2	7.58	2.76	36.35	9	1	10	
Overall	G1	44.77	18.29	40.84	49.5	3	66	0.004*
	G2	57.37	9	15.68	61	33	66	
Auditory Memory	Group	Mean	SD	CV	Median	Minimum	Maximum	p-value
memory, words	G1	3.46	0.65	18.69	3	2	5	0.09
	G2	3.79	0.63	16.64	4	3	5	
memory, non-words	G1	2.69	0.47	17.48	3	2	3	0.2
	G2	2.89	0.57	19.59	3	2	4	
memory, digits	G1	4.08	0.89	21.85	4	2	5	0.003*
	G2	4.95	0.97	19.61	5	3	7	
RAN		Mean	SD	CV	Median	Minimum	Maximum	p-value
Colors	G1	0.74	0.43	58.21	0.535	0.37	2.33	0.04*
	G2	0.52	0.28	52.5	0.43	0.25	1.22	
Letters	G1	0.43	0.17	39.3	0.425	0.26	1.13	0.002*
	G2	0.3	0.09	30.33	0.27	0.16	0.53	
Digits	G1	0.48	0.22	45.74	0.43	0.26	1.05	0.001*
	G2	0.31	0.08	25.45	0.29	0.16	0.47	
Objects	G1	1.29	0.51	39.48	1.185	0.55	3.24	0.0001*
	G2	0.76	0.33	43.1	0.58	0.33	1.36	

\* Statistically significant values at  $p < 0.05$  (Mann-Whitney test)

**Legend:** SD: standard deviation; CV: coefficient of variation; CVC: consonant-vowel-consonant; CCV: consonant-consonant-vowel. Statistical test: Mann-Whitney.

Comorbid conditions did not seem to influence the severity of the alterations in phonological awareness, memory and RAN so markedly as age did (Tables 2, 3 and 4). It should be stressed, however, that phonological awareness was the task most influenced by the presence of comorbid disorders among the competencies tested in the present study.

Among the most frequently comorbid conditions in G1 were learning disorder (38.89%), developmental coordination disorder (22.23%), epilepsy (11.12%), cognitive deficit (11.12%), phacomatosis (1%), anxiety disorder (1%), bipolar mood disorder (1%), and nonverbal learning disorder (1%). In G2, the

comorbidities were learning disorder (50%), developmental coordination disorder (16.67%), epilepsy (16.67%) and psychiatric disorder (16.67%).

Because differences were found for the variable “age” in nearly all comparisons, the age range was disregarded when comparisons were made for the variable “comorbidity”. Consequently, regarding this variable, two comparisons were conducted in each test: a cross-tabulation of the results pertaining to the individuals with comorbid disorders (24 individuals, 8 in G1 and 6 in G2); and to the individuals without comorbid disorders (21 individuals, 8 in G1 and 13 in G2) (Tables 2, 3 and 4).

**Table 2 - Comparison of groups G1 and G2 according to the variable “comorbidity” for the phonological awareness test**

			Rhyme	Syllable deletion	Syllablere version	Phoneme segmentation	Phoneme deletion (CVC CCV)	Phonemere version	Total
Without comorbidity	G1	Mean	7.64	9.2	7.9	5.2	16.727	8.273	54.91
		SD	1.21	0	1.5	2.3	5	3.41	10.78
	G2	Mean	7.7	9.8	9.7	6.7	18.2	8.7	60.8
		SD	0.67	0.63	0.48	1.42	2.78	1.42	5.96
With comorbidity	G1	Mean	5.94	8.9	7.7	4.5	9.111	5.278	41.39
		SD	2.48	2.2	3.7	2.7	7.5	3.95	19.59
	G2	Mean	6.33	10	8.5	5.5	14.17	5	49.5
		SD	1.21	0	1.52	2.26	.96	3.41	10.78
<i>p</i> -value	G1		0.01*	0.7	0.8	0.6	0.003*	0.008*	0.03*
	G2		0.04*	0.3	0.1	0.3	0.1	0.04*	0.05

\* Statistically significant values at  $p < 0.05$  (Mann-Whitney test).

**Legend:** SD: standard deviation; CVC: consonant-vowel-consonant; CCV: consonant-consonant-vowel. Mann-Whitney test.

**Table 3 - Comparison of groups G1 and G2 according to the variable “comorbidity” for the auditory memory tests**

			memory, words	memory, non-words	memory, digits
Without comorbidity	G1	Mean	3.6	2.91	4.64
		SD	0.5	0.6	1.2
	G2	Mean	3.90	2.80	4.90
		SD	0.74	0.63	0.99
With comorbidity	G1	Mean	3.4	2.61	3.94
		SD	0.7	0.5	0.9
	G2	Mean	3.67	3.00	4.83
		SD	0.52	0.63	1.17
<i>p</i> -value	G1		0.3	0.06	0.06
	G2		0.5	0.6	0.9

**Legend:** SD: standard deviation. Mann-Whitney test.

## ■ DISCUSSION

The results found in the present study show that the performance of the G1 individuals in the phonological awareness tests was inferior compared with that of G2 across items (Table 1). That is in accordance with the literature, which reports that younger individuals have greater difficulties, and that the progression of age influences the improvement of phonological awareness skills<sup>15,19,20</sup>. The same was found to occur with individuals who have ADHD.

It is also noteworthy that the G1 individuals performed better in the syllabic aspects, with 83% of correct answers vs. 54% for the phonemic aspects. The same was true for the individuals in G2, who obtained 95% of correct answers in the syllabic vs.

78% in the phonemic aspects. This finding corroborates research in this area, which show that syllabic abilities are acquired earlier than phonemic skills<sup>8,20</sup> and this is nodifferent for individuals with ADHD. However, the present analysis demonstrated that the G2 individuals performed better than G1 with respect to the competencies of syllabic reversion and phoneme segmentation and deletion, which determined a difference in the total of all competencies related to the phonological awareness skills. This finding was statistically significant (Table 1) and the reason may be that the younger individuals are in a period when the degree of hyperactivity, inattention and impulsiveness is most prominent<sup>5,21</sup>. Furthermore, the diagnosis of ADHD is usually confirmed at the pre-school and school age, and the



therapeutic management generally starts around 6 years of age<sup>3</sup>.

When a comparison is made of the competencies of the phonological awareness skills in individuals with and without comorbid conditions (Table 2), interesting results are observed. The noncomorbid ADHD individuals were also separated by age range as previously described (since differences were found in nearly all comparisons made), following, therefore, the same division of G1 and G2. Thus, the intragroup results for individuals without and with comorbid conditions are not statistically different. However, when G1 individuals without comorbidity were compared with individuals having comorbid conditions within the same age range (G1), differences were found for rhyme detection and phonemic aspects of phoneme deletion and reversion. This resulted in a statistically significant total of correct answers. Previous investigation<sup>15</sup> showed that among the individuals with and without complaints of difficulties at school, there are significant differences in rhyme detection and in the phonemic aspects of phonological awareness. The difficulties in the phonemic aspects are consistent with the literature. However, rhyme detection was not demonstrated in the previous studies related to that research.

The same was not true for G2 individuals without comorbid disorders compared with those with such disorders within the same age range (G2) (Table 2). However,  $p$ -values  $< 0.05$  were considered to be statistically significant, and here the result of the comparison of G2 individuals without and with comorbid ADHD was exactly  $p = 0.05$ , which reveals a tendency of attributing greater difficulty to individuals with comorbid ADHD in the competencies of rhyming and phonemic reversion. The presence of comorbidity partially affected phonological awareness skills in individuals aged between 7 years and 10 years 11 months. It is suggested that the corpus of the sample should be broadened in order to confirm this tendency.

In the present study sample (45 individuals), the prevalence of comorbid disorders was 53.34%, of which 41.67% had learning disorder as the major comorbidity. This contrasts with the literature, which indicates conduct disorder as the most frequent comorbid condition among ADHD individuals<sup>22,23</sup>. The incidence of learning disorder as a comorbid condition in the sample of the present study may be linked to the profile of the LETRA clinic and to the fact that the study sample was specific and not representative of the population as a whole.

The results found for the ability to access the mental lexicon revealed differences across levels in the two groups of the sample when compared by age (Table 3). The G2 individuals showed greater

access speed and shorter time across levels; greater difficulty was found when naming objects, and better performance in naming letters, followed by numbers and colors. The individuals in G1 had the same sequence in performance difficulty letters, numbers, colors and objects. These findings corroborate previous studies<sup>14,24</sup> revealing higher naming speed for letters and digits than colors and objects, since naming stimuli requires using more extensive and complex attentional, perceptive and visual processes. In addition, one study reports<sup>14</sup> that, in order to name objects, first an association has to be established with their meaning, and only subsequently can the objects be named. Comparing the results of this study with the literature reporting on individuals without complaints<sup>14</sup> and using the same RAN testing, it can be noted that individuals with ADHD need more time to name and access their lexicon, and when comorbid conditions are present, this length of time tends to increase. This can be explained by the difficulty in the attentional processes found in these individuals, which is also consistent with the literature<sup>3,21</sup>.

When the RAN test results are analyzed from the viewpoint of comorbid disorders vs. age (Table 4), no tendency towards a distinction between the sample groups is found in relation to the tasks of naming digits, colors and objects. With respect to naming letters, there were statistical differences, with G2 individuals performing better than G1 individuals.

Analyzing the means obtained in the RAN test by the G2 individuals without comorbid disorders, the results were similar to those obtained by individuals without complaints in a previous study<sup>14</sup>. However, G2 comprises individuals with an age range between 11 and 16 years, and the age range of the aforementioned study<sup>14</sup> corresponds to individuals between 7 and 11 years. This reveals a tendency toward normalization of the access to the mental lexicon in individuals with ADHD, as in the individuals without complaints with the progression of age. However, the ability to rapidly retrieve stored information through the executive functions is impaired in individuals with ADHD, since these abilities demand cognitive processes supraordinated by organized behaviors that depend directly on self-regulation and inhibitory behavior<sup>3,25</sup>. Authors<sup>26</sup> concluded that children with ADHD have similar cognitive abilities to those who do not have the disorder; however, because of the attentional difficulties, children afflicted with ADHD take longer to acquire the necessary skills for academic performance.

When searching for other studies with RAN testing administered to individuals with ADHD so correlations could be drawn, one study<sup>24</sup> brought results from a control group and a group of

individuals with ADHD. In that study, it was possible to obtain relatively superior results to those found in the present study, which shows that, at all levels of the RAN tasks, the individuals without and with comorbid disorders demanded a longer period of time to access and verbalize the answers; the younger comorbidly afflicted individuals (ages between 7 years and 10 years 11 months) had significantly poorer performance means. This implies a greater length of time to access the mental lexicon. Moreover, it should be stressed that the above-mentioned study used a sample of individuals aged between 8 years 4 months and 12 years 11 months with no comorbid ADHD; this could account for such a difference, since the individuals with comorbid conditions in the present study performed at a lower speed and consumed more time to name all the categories assessed by the RAN test. It is worth noting that, in the present study, the G1 individuals with comorbid ADHD (age between 7 years and 10 years 11 months), when correlated with the comorbidly afflicted individuals in G2 (age between 11 and 16 years), tended to demand a greater length of time for naming only in the categories of colors and objects (Table 4). In tasks involving naming letters and digits, on the other hand, the results are similar between the comorbid ADHD individuals in G2 and the group of individuals with ADHD in the respective study in the literature<sup>24</sup>.

In another study<sup>14</sup> whose sample was composed by individuals without complaints about school deficits (age between 7 and 11 years), the maximum and minimum speed/time obtained across the RAN test categories corroborated the present study when compared to individuals with noncomorbid ADHD in both groups. This leads to the reflection that, as far as these skills are concerned, individuals with pure ADHD tend to perform similarly to those without complaints. It should be stressed, however, that confirmation of this finding would require further research using a group-control design.

Regarding phonological working memory skills, the memory test revealed that when individuals were allocated into groups according to their age means (G1 and G2), the only parameter showing a statistically significant difference was competency in memory of digits (Table 1), in which the G2 individuals showed greater memorization skills compared with G1. This result may indicate that phonological working memory tends to remain unchanged with the passing of years.

Previous research<sup>25</sup> conducted with individuals of typical development aged between 8 and 11 years, equivalent to the 2nd and 5th grades of elementary school, showed working memory ability results close to the findings of the present study with individuals

who have ADHD, both in the analysis of the variable “age” and the variable “comorbidity”, which is consistent with the literature, as it found no statistical significance in the working memory processes of individuals with ADHD<sup>7,26</sup>.

It was also necessary to compare working memory performance according to the presence or absence of age-related comorbid conditions (Table 3). No differences were found in any of the parameters evaluated. This finding supports the hypothesis that the presence of comorbidity does not impact working memory ability in individuals with ADHD. Nor does it distinguish them from individuals without disorders regarding this phonological processing skill, which corroborates the findings of preliminary studies<sup>7,25,27</sup>.

Although the present study raised important points regarding the functioning of phonological processing skills in individuals with ADHD, future research should aim at correlating these variables with those obtained from a control group, in order to assess the level of significance of each one of the skills of individuals with ADHD that were discussed here in comparison with their peers.

## ■ CONCLUSION

The variable “age” implies greater deficits in individuals aged between 7 years and 10 years 11 months, especially in phonological awareness tests. It is noteworthy that the greatest difficulty was found in phonemic awareness abilities. The same was not true for the comparison between the comorbid and noncomorbid groups when the age range was disregarded, as no significant differences were then noted. When these groups were compared within the same age range, the individuals with comorbidity were found to have a deficit relative to the individuals without comorbidity, especially when the younger individuals were compared. Therefore, comorbid disorders are a complicating factor in the acquisition of phonological awareness skills and age is an important factor in these comparisons, since younger individuals have more difficulty than older ones in this ability, both with respect to comorbid ADHD individuals and noncomorbid individuals. In the RAN test, age (younger individuals) and comorbidity were statistically significant, indicating that both are relevant factors in accessing the mental lexicon. No alterations were found in the working memory test for the variables examined in the present study.

Currently, there are few studies showing the phonological processing alterations in individuals with ADHD, which warrants further research aiming at providing deeper insight into this theme.



**RESUMO**

**Objetivo:** analisar e descrever o desempenho das habilidades dos componentes do processamento fonológico nos sujeitos com Transtorno do Déficit de Atenção e Hiperatividade (TDA/H). **Métodos:** trata-se de estudo descritivo analítico dos dados de avaliação das habilidades do processamento fonológico de 45 sujeitos, com idade entre 7 e 16 anos, com diagnóstico multiprofissional de TDA/H. Os dados foram obtidos pela análise dos prontuários dos sujeitos avaliados pelo Laboratório de Estudo dos Transtornos de Aprendizagem (LETRA) do Hospital das Clínicas da Universidade Federal de Minas Gerais (UFMG), nos anos de 2008 a 2011. Os resultados analisados incluem a prova de Consciência Fonológica proposta pela bateria de testes BELEC, prova de Nomeação Seriada Rápida (RAN) e Memória Auditiva. Duas variáveis foram consideradas nesta análise: idade e presença ou não de comorbidades associadas. O teste aplicado para caracterização da amostra foi o não paramétrico de Mann Whitney. **Resultados:** os grupos tendem a se diferenciarem ao se analisar a variável idade, nas provas de consciência fonológica e RAN. Quando a variável comorbidade foi analisada, a consciência fonológica é a mais influenciada pela presença de comorbidades. Na habilidade de memória fonológica, sob a mesma ótica, não houve diferenças entre os grupos. **Conclusão:** o maior déficit do processamento fonológico foi observado na habilidade de consciência fonológica, segundo as variáveis idade e comorbidade, seguido pela habilidade de acesso ao léxico, na variável idade. Já para a memória de trabalho não houve significância.

**DESCRIPTORIOS:** Transtorno do Déficit de Atenção com Hiperatividade; Aprendizagem; Criança; Memória; Cognição

**■ REFERENCES**

- American Psychiatric Association. *Diagnostical and statistical manual of mental disorders*. 4a ed. Washington DC: American Psychiatric Association; 2000. Disponível em <http://virtualpsy.locaweb.com.br/dsm.php>.
- Gomes M, Palmieri A, Barbirato F, Rohde LA, Mattos P. Conhecimento sobre o transtorno do déficit de atenção/hiperatividade no Brasil. *J Bras Psiquiatr*. 2007;56(2):94-101.
- Jou GI, Amaral B, Pavan CR, Schaefer LS, Zimmer M. Transtorno de déficit de atenção e hiperatividade: um olhar no ensino fundamental. *Psicol .Reflex. Crit*. 2010;23(1): 29-36.
- Brook U, Geva D. Knowledge and attitudes of high school pupils towards peers' attention deficit and learning disabilities. *Patient Educ Couns*. 2001;43:31-6.
- Cunha VLO, Silva C, Lourencetti MD, Padula NAMR, Capellini SA. Desempenho de escolares com transtorno de déficit de atenção e hiperatividade em tarefas metalinguísticas e de leitura. *Rev. CEFAC* [online]. ahead of print, Epub 09-Jan-2012. p 1-11. Disponível em: <http://www.scielo.br/pdf/rcefac/2012nahead/67-11.pdf>
- Silveira DC, Passos LMA, Santos PC, Chiappetta ALML. Avaliação da fluência verbal em crianças com transtorno da falta de atenção com hiperatividade: um estudo comparativo. *Rev CEFAC*. 2009;11(Supl 2):208-16.
- Ygual-Fernández A, Cervera-Mérida JF, Baixauli-Fortea I, Meliá-De Alba A. Protocolo de observación Del lenguaje para maestros de educación infantil. *Rev Neurol*. 2011;52(Supl 1):127-34.
- Capovilla AGS, Capovilla FC. *Problemas de leitura e escrita: como identificar, prevenir e remediar numa abordagem fônica*. São Paulo. Ed. Memnon, 2000.
- Capellini SA, Conrado TLBC. Desempenho de escolares com e sem dificuldades de aprendizagem de ensino particular em habilidade fonológica, nomeação rápida, leitura e escrita. *Rev CEFAC*. 2009;11(Supl 2):183-93.
- Ávila CRB, Capellini SA. Relation between oral and written language. In: Capellini SA. *Neuropsycholinguistic perspectives on dyslexia and other learning disabilities*. New York: New Science Publisher; 2007. p.15-22.
- Alves LM, Mariz VF, Bicalho CRD. Investigação das habilidades de memória e nomeação rápida em alunos do ensino fundamental. *Biblioteca Virtual Fantásticas Veredas – FGR*. 2011,p.2.
- Lima RF. Compreendendo os mecanismos atencionais. *Ciência Cognição*. 2005;(6):113-22.
- Rotta NT, Ohlweiler L, Riesgo RS. *Transtornos da aprendizagem: abordagem neurobiológica e multidisciplinar*. Porto Alegre: Artmed; 2006.

14. Bicalho LGR, Alves LM. A nomeação seriada rápida em escolares com e sem queixas de problemas de aprendizagem em escola pública e particular. *Rev CEFAC*. 2010;12:608-16.
15. Alves LM, Maia GF. Consciência fonológica em escolares. [Trabalho de conclusão de curso]. Belo Horizonte (MG): Centro Universitário Metodista Izabela Hendrix. Curso de Fonoaudiologia; 2008.
16. Godoy DMA. Testes de consciência fonológica e suas relações com a aprendizagem da leitura no português [dissertação]. Florianópolis, SC: Universidade Federal de Santa Catarina; 2001. Disponível no URL: <http://www.bu.ufsc.br/aceeso.html>.
17. Ferreira TL, Capellini SA, Ciasca SM, Tonelotto JMF. Desempenho de escolares leitores proficientes no teste de nomeação automatizada rápida – RAN. *Temas Desenvolv*. 2003;12(69):26-32.
18. Damasceno A, Alves LM, Sá R de, Barezani T. Desempenho em atividade de memória verbal de curto prazo em crianças do ensino fundamental com e sem queixas de alterações da aprendizagem. In: XV Congresso de Brasileiro de Fonoaudiologia e VII Congresso Internacional de Fonoaudiologia; 2007, Out 16-20; Gramado – RS. *Rev Soc Bras Fonoaudio*; 2007.
19. Silva C, Capellini SA. Correlação entre tempo, erro, velocidade e compreensão de leitura em escolares com distúrbio de aprendizagem. *Rev Soc Bras Fonoaudiol*. 2011;16(4):412-6.
20. Ettore B, Manguiera ASC, Dias BDG, Teixeira JB, Nemr K. Relação entre consciência fonológica e os níveis de escrita de escolares da 1º série do ensino fundamental de escola pública do município de Porto Real – RJ. *Rev CEFAC*. 2008;10(2):149-57.
21. Rohde LA, Barbosa G, Tramontina S, Polanczyk G. Transtorno de déficit de atenção/hiperatividade. *Rev Bras Psiquiatr*. 2000;22(Supl II):7-11.
22. Rohde LA, Biederman J, Busnello EA, Zimmerman H, Schmitz M, Martins S, et al. ADHD in a school sample of Brazilian adolescents: a study of prevalence, comorbid conditions, and impairments. *J Am Acad Child Adolesc Psychiatry*. 1999;38:716-22.
23. Possa MA, Spanemberg L, Guardiola A. Comorbidades do transtorno de déficit de atenção e hiperatividade em crianças escolares. *Arq Neuropsiquiatr*. 2005;63(2-B):479-83.
24. Capellini SA, Ferreira TL, Salgado CA, Ciasca SM. Desempenho de escolares bons leitores, com dislexia e com transtorno do déficit de atenção e hiperatividade em nomeação automática rápida. *Rev Soc Bras Fonoaudiol*. 2007;12(2):114-9.
25. Miranda-Casas A, Fernández MI, Robledo P, García-Castellar R. Comprensión de textos de estudiantes con trastorno por déficit de atención/hiperactividad: ¿qué papel desempeñan las funciones ejecutivas? *Rev Neurol*. 2010;50(Supl 3):S135-42.
26. Messina LF, Tiedemann KB. Avaliação da memória de trabalho em crianças com transtorno do déficit de atenção e hiperatividade. *Rev Psicologia USP*. 2009;20(2): 209-28.
27. Alves LM, Ribeiro MM. Desempenho em memória de trabalho em escolares com e sem queixas de alterações de aprendizagem. *Rev Tecer*. 2011;4(6):54-65.

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